

Marked-Up Version of Substitute Specification

Description

PRODUCTION OF A COMPLETE IMAGE BY SCANNING PARTIAL AREAS OF A PATTERN

5 BACKGROUND

The ~~invention~~ present disclosure relates to a method ~~according to the preamble of Claim 1~~ for producing a resulting image from a plurality of individual images.

Such a method can, for example, be used to obtain a panoramic image, or
10 ~~also to scan documents.~~

The solid angle given by a camera and objective, ~~which~~ that is scanned or recorded by an image, is in many situations inadequate for completely recording objects from the surroundings. ~~The use of~~ In particular, the use of wide-angle objectives to completely record objects is not always possible, or always desired.
15 Because of the characteristics of ~~the lenses~~, a very wide-angle objective causes extreme distortions at the edges of the image ~~which~~ that interfere considerably with the impression. Furthermore, the quality of the display of the object display is disturbed by the limited sensor resolution. In addition, in many cases, however, replacement of the lens or of the objective is not possible ~~either, because this the~~
20 component is firmly integrated into the camera.

Many previous methods ~~have already been used which have attempted to~~ dealt with a similar subject. ~~The focus of the observation here was frequently unrelated to the generation of panoramic images.~~ To correcting the sensor defect,
25 Hhowever, the known previous methods for generating images of a larger field of vision require very expensive and complex arithmetical operations that cannot be performed in real time video ~~time~~ to correct the lens and image distortion. For this reason, a calculation of an image with an extended field of vision can generally only be performed offline ~~as a rule.~~

The images used to generate the resulting image of the previous methods
30 only require a slight overlap ~~in this method~~ in the individual images. In ~~this those~~ cases, two adjacent images or two consecutive images contain only a little common

image information. ~~Furthermore, Depending on the environment, however,~~ the images ~~therefore integrally may~~ contain quite different lighting conditions. ~~Therefore, as a result of An aperture control on the camera, however, results in there will~~ exist extremely varied illuminations at the spliced edges of the resulting image, ~~which that~~ can likewise only be harmonized ~~again at a~~ very great cost.

Fax equipment and flatbed scanners enable the electronic transmission of documents which are available on paper. In many situations ~~the availability of this type of equipment is not available,~~ for example, during a meeting, ~~is not always guaranteed.~~ An alternative to the use of a fax machine or a flatbed scanner is such a situation is a digital camera, with which the image information can ~~also be~~ saved in digital form. However, the resolution of standard commercial cameras is not yet sufficient to produce adequate resolution for a document in a single exposure.

The scanning of documents by means of many individual images close up to the document to increase the resolution is a known approach. Until now, ~~however,~~ there have only been a few, in part, very unstable methods that can be used to compose a two-dimensional complete image from the individually recorded images again.

Most of these methods are based on the image information ~~at first~~ being distorted at an initial processing stage by highly complex arithmetical operations. ~~Then, a~~ At a subsequent processing stage, the adjacent image information is ~~then~~ harmonized with the adjacent images in all four edge directions. Each image is corrected both horizontally and vertically in relation to the adjacent images. The images, ~~therefore,~~ only require a slight overlap ~~for to accomplish~~ this. ~~Each image is corrected both horizontally and vertically in relation to the adjacent images.~~ Besides the scarcely tolerable high calculation time, these methods frequently lead to rhombic distortion of the image information which distracts the observer greatly, as shown, for example, in (cf. Figure 1). ~~On account of their complexity, the known methods can frequently generally~~ only be performed interactively, and offline.

SUMMARY

The ~~object of the invention~~present disclosure ~~is relates to indicate~~ a method of the type mentioned at the beginning ~~which~~for providing a high-quality resulting image from a plurality of individual images, without a great amount of calculation.

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~~This object is achieved~~An example of the method for producing a resulting image from a plurality of individual images according to the invention-present disclosure comprises producing the plurality of individual images using a scanning movement, offsetting the individual images in relation to each other, obtaining
10 image information from the individual images as a function of the offsetting, and producing the resulting image using the obtained image information~~by the features indicated in Claim 1.~~

Some benefits of ~~The method according to the invention-present disclosure~~
15 include ~~has the following advantages:~~

the R~~apid~~ processing of the images to produce a resulting image,
elimination of the need to C~~orrection~~ of the lens errors or mapping errors in the image ~~involving utilizing~~ intensive calculations ~~is not necessary,~~
elimination of the need to H~~armonization~~ of the illumination at the
20 ~~spliced edges is rendered unnecessary by virtually continuous image scanning, and~~
c

Controlling ~~of the additional~~ image information as a function of the image ~~misalignment~~offsetting.

~~The invention is described in more detail hereinafter with reference to an~~
25 ~~exemplary embodiment shown in the diagram. The diagram shows:~~

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an example of ~~—— a complete resulting image~~ prepared from individual exposures ~~—— according to the prior art,~~

Figure 2 shows an example of ~~—— a resulting image~~ generated by
30 scanning the surroundings,

Figure 3 illustrates an example of—a scanning movement for scanning a document.

Figure 4 illustrates an example of—the image recorded during the scanning movement according to Figure 2.

5 Figure 5 illustrates an example of—the result of successive one-dimensional scans, ~~and~~.

Figure 6 illustrates an example of—the resulting image according to the ~~method according to the invention~~ present disclosure.

DETAILED DESCRIPTION OF THE PRESENT EXAMPLES

10 The method according to the ~~invention~~ present disclosure is based on the production of individual images which are generated during a one- or two-dimensional scanning movement.

According to the ~~invention~~ present disclosure individual images are generated which overlap each other to a high degree. This produces a ~~complete~~
15 resulting image with almost no distortions ~~which that~~ covers a very large solid angle. ~~The method~~ This also makes it possible, for example, to produce panoramic images or ~~also~~ to scan in documents with a very high resolution.

In doing so, the image sensor operates, for example, at full scanning frequency, so that by slowly swiveling across the object to be recorded, adjacent
20 images are only slightly offset against each other. From each image, a part of the undistorted image information is copied from the center of the image into a resulting image. The size of the copied ~~picture~~ portion detail is controlled as a function of the calculated offset to the previous image. As two adjacent images overlap to a very high degree, the images have almost identical lighting conditions
25 so that when adjacent edges are put together, as a rule no harmonization of the illumination is necessary.

~~To perform~~ An embodiment of the method according to the invention ~~present disclosure could~~, for example, be used with a mobile telephone having a ~~with the following components is used~~:

30 Camera module ~~on the reverse of the mobile telephone~~ for recording images from the surroundings,

~~Pa~~ processor for processing ~~the~~ image data and for generating the resulting image (i.e., estimate of movement, image composition, etc.), ~~and a~~

~~D~~isplay for ~~displaying the resulting image.~~ ~~display~~

~~The function to~~ An example of generating the resulting image (cf. also as
5 shown in, for example, Figure 2,) on the basis of an image sequence, essentially
~~comprises~~includes the following processing stages:the

Estimation of movement of two adjacent images, as well as the

Structure of the resulting image.

~~In the following sections the individual processing stages of~~ The above
10 methods are explained in more detail herein with the simplification assumption, for
illustrative purposes only, that the scan follows the surroundings one-
dimensionally from right to left.:

Regarding the 1) Estimation of movement of two adjacent images,

~~The movement of two adjacent images is determined, for example,~~
15 ~~according to the~~ a MSE (Mean Squared Error) method. In the MSE is-method, the
best possible match in a local neighborhood to the previous image is sought for an
image area of the initial image. The best match provides the displacement vector of
the two images relative to each other.

Regarding the 2) Ustructuring of ~~pd~~ating the resulting image,

20 ~~On~~ using ~~the basis of~~ the displacement vector, the position inside the
resulting image to which the additional image information is copied is ascertained.
The width of the additional picture copied portion detail of the initial image is
provided by the offset of the images in the direction of scanning, for this example
in the horizontal direction from right to left (i.e., direction x). In this way no gap
25 ~~arises between the~~ picture copied portion detail already put together and the added
picture copied portion detail. Vertical Perpendicular to the direction of scanning
(i.e., direction y), the complete image information is taken into account. The result
of the processing of many images according to this method can be seen, for
example, in Figure 1.

30 ~~In a development of the method a~~ According to the invention present
disclosure, scanning of the document takes place by means of a zigzag movement

of the camera across the document at a constant distance, as shown in, for example,
(~~ef~~-Figure 3). In order to avoid variations in the distance to the document and
consequently changes in the size of the images during the scanning process, for
example, the camera is guided across the document on a frame with the camera
5 pointing vertically downwards towards the document to be scanned. By analyzing
the movement of consecutive images, the two-dimensional scan is separated into
several one-dimensional (i.e., horizontal) scans as shown, for example, in (~~ef~~-
Figures 4 and 5). Each one-dimensional scan shows a horizontal, undistorted strip
of the original document. By separating the two-dimensional scan into several one-
10 dimensional scans, the ~~problem of~~ document generation task is reduced to
horizontal scaling of the image strips, and the putting together of the horizontal
strips in a vertical direction, as shown, for example, in (~~ef~~-Figure 5). By linearly
scaling of all of the image information, avoids-rhombic distortions are avoided in
the complete resulting image, as occurs in traditional previous methods, as shown
15 in, for example, (~~ef~~-Figure 6).

It should be understood that various changes and modifications to the
presently preferred embodiments described herein will be apparent to those skilled
in the art. Such changes and modifications can be made without departing from the
spirit and scope of the present invention and without diminishing its intended
20 advantages. It is therefore intended that such changes and modifications be covered
by the appended claims.

~~Abstract~~

ABSTRACT

The ~~invention~~ present disclosure relates to a method for ~~obtaining~~
producing a resulting image from a plurality of individual images. The method
5 includes ~~using~~ producing a plurality of individual images ~~which can be~~
~~successively produced during~~ using a scanning movement. ~~According to the~~
~~invention, the successive~~ and offsetting the individual images ~~are slightly offset in~~
relation to each other,; and ~~The method further includes obtaining image~~
information ~~is obtained from the individual images according to the misalignment~~
10 offsetting, and copied into the producing the resulting image using the obtained
image information.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of claims:

Claims 1-2 (cancelled).

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Claim 3 (new): A method for producing a resulting image from a plurality of individual images, the method comprising:

producing the plurality of individual images using a scanning movement;

offsetting the individual images in relation to each other;

10 obtaining image information from the individual images as a function of the offsetting; and

producing the resulting image using the obtained image information.

15 Claim 4 (new): The method as defined in claim 1, wherein the scanning movement is two-dimensional.

REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification, which includes the Abstract, in order to conform the specification to the requirements of United States patent practice. No new matter is added thereby. The present amendment also includes a Substitute Specification including a marked-up version of the changes made to the specification by the present amendment.

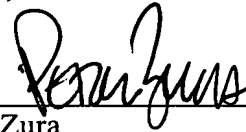
In addition, the present amendment cancels original claims 1-2 in favor of new claims 3-4. Claims 3-4 have been presented solely because the revisions by red-lining and underlining that would have been necessary in claims 1-2 in order to present these claims in accordance with preferred United States patent practice would have been too extensive and burdensome. The present amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-2 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-2.

Early consideration on the merits is respectfully requested.

Respectfully submitted,

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